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ABSTRACT

The unprecedented growth of the information sources concerning science and technology makes it particularly urgent that the processes of information storage, information retrieval, information processing according to needs, representation of results and their storage in preparation for the subsequent processing stages be mechanized. With this end in view, it is necessary to produce a central "data base" in a "machine-readable form," which is accessible to creation, updating, processing and retrieval programs. This project describes the software system which creates the data base for the periodical purchasing department of a library and processes it by mechanizing the yearly cycle of activities. The following subjects are discussed: description of activities comprised in the yearly cycle; design of the data base; review of the mechanized processes; organizational and working routines; the forms of input-output; error checks at different stages; and system analysis and planning for the future. The Project lays stress on improving the familiarity of the librarian with the entirety of the data and activities involved. Its other purpose is to supply the contact between the librarian and the computer for the convenience of the librarian, who is not expected to be a computer expert. (Author)

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AUTOMATED ACQUISITION OF PERIODICALS

L.A.SER.

(Library Automation - Serials)

By

GEDALIA KADMON

Ministry of Defence - A.D.A.
Documentation and Information Department

R E S U M E

The unprecedented growth of the information sources concerning Science and Technology makes it particularly urgent that the processes of information storage, information retrieval, information processing according to needs, representation of results and their storage in preparation for the subsequent processing stages be mechanized. With this end in view, it is necessary to produce a central data base in a machine-readable form, which is accessible to creation, updating, processing and retrieval programes.

This project describes the software system which creates the data base for the periodical purchasing department of a library and processes it by mechanizing the yearly cycle of activities.

The following subjects are discussed:

Description of activities comprised in the yearly cycle.
Design of the data base.
Review of the mechanized processes.
Organizational and working routines.
The forms of input/output.
Error checks at different stages.
System analysis and planning for the future.

The Project lays stress on improving the familiarity of the librarian with the entirety of the data and activities involved. Its other purpose is to supply the contact between the librarian and the computer for the convenience of the librarian, who is not expected to be a computer expert.

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2. PROGRAMMING CONCEPTS

This chapter is intended for those who are not familiar with the technical terms of computer science. The explanations given below are intended to enable the reader to understand the considerations which follow, and are not the exact definitions of the terms.

In order to make the computer carry out a given task, the latter is presented to it in the form of a program, written in one of the languages recognized by the computer. In general, the program will have the form of a deck of punched computer cards, which is known as a job and is sent for a run through the computer. This card deck comprises three kinds of cards:

* A set of control cards, which indicates to the computer how to use the card deck (the language in which the program is written, the available sources of information other than the card deck, where to send the results, etc.);
* A set of program cards, which comprises the working program for this particular task;
* A set of data cards, which contains all the data required for the execution of the task.

The third kind of cards is the input of the program, but these cards often contain only a part of the input. The remaining input may be stored on a magnetic disk or on magnetic tapes which are generally located in the computer centre. The results of processing each job constitute the output, which may be recorded in a manner which has been predetermined by the program, in one or more of the following ways:

It may be printed on computer paper or punched on cards by the card puncher, or punched on a paper tape or magnetically recorded on disks or tapes.

The information contained in the input (and in the output) is placed in fields of predetermined size and location; in this way the information contained in it can then be located.

A set of fields can be combined to a record, and a set of records may be combined to constitute a file. The central file, which contains the basic

information pertaining to the system, is known as the master file.

Files are always kept on an external medium, such as magnetic disk or magnetic tape; they are then referred to as permanent files. Such files may be of two kinds: in sequential access files the contents of the file must be scanned from the beginning to the location sought, before the information can be retrieved; in direct access files the information can be retrieved directly, provided the file is built as a random file.

An assembly of external memories for repeated use is also known as mass storage.

3. YEARLY CYCLE OF ACTIVITIES INVOLVED IN THE PURCHASE OF PERIODICALS

A. Collection of all the relevant information concerning each periodical (Title), for the compilation of the periodical master file.

B. Publication of classified list of periodicals (which were ordered for the current year). The list is then circulated to individual departments who mark the periodicals which they wish to receive during the coming year.

C. Preparation of Synoptic List of orders for each title and dispatch of orders to suppliers.

D. Accounting work: payment of suppliers' invoices and debiting the accounts of individual departments in proportion to the quantities appearing in the invoice.

E. Verification of receipt of all copies due, and dispatch of copies to their destinations. Issuance of claims to publishers for copies which failed to arrive.

F. Special activities: reviews, statistical surveys.

4. CREATING AND UPDATING THE MASTER FILE (M.F.)

The master file (M.F.) serves as the central data base of the system and services most of the mechanized activities. It acts as input for a large number of programs and also as output in which the results of current activities and updating are recorded. Its structure must accordingly be convenient for generation and updating, and the information contained therein must be easy to retrieve. It must contain all the information relevant to each title, and must be elastic enough to accommodate information of different lengths for different titles. (The word "Title" will be denoted as "T", for the sake of brevity).

The following solution was adopted for the structure of the master file:

A M.F. record is created for each T, and contains all the information pertinent to this particular T. The length of the records is variable, and each record contains a special field which acts as meter for the determination of its effective size.

When this record has been placed on the disk, the amount of space it occupies corresponds to its size and not to the size of the largest record on the disk. In this way space is saved in the memory of the permanent file.

To each T is assigned an alphabetic code, which is known as coden. It consists of 6 letters, five of which represent a mnemonic for the T, whereas the sixth is a check letter, which is calculated from the preceding five.

All these records constitute a set, the structure of which is that of a random file, with direct access to each record. The coden of each record is the key through which access is gained to the record. This means that the user who wishes to read the content of a given record from the disk, or to update it, only has to give its coden; when the "read" order from the disk is obeyed, the record which carries the specified coden is transferred from the disk to the working area of the program, and can then be employed as desired.

4.1 Structure of a M.F. record (figure No. 8)

Within each record the various kinds of information are classified in two grades, which will be referred to as "type" and "level". In the figure, "type" is shown in columns 8 and 9, while "level" is shown in columns 10 and 11.

Type 1 contains the T, including former T if any.

Type 2 contains the information on the periodical which remains more or less constant, such as country of origin, number of issues per volume, dates of beginning and end of subscription, frequency of appearance of the periodical, name and address of publisher etc.

The significance of other types will be explained at a later stage.

4.2 Creation and Update Program

In order to create a master file, the information must be submitted in the form of data cards (figure No. 1). The structure of each card is: coden, type, level, information.

The cards need not be sorted. Sorting can be more efficiently and more conveniently carried out by the computer, without introducing human error. The only condition is that each periodical have its type 1 card, in addition to the other cards of this T. This is because each T in the M.F. has its own record, which is inserted alphabetically in the record sequence in the file; for such an arrangement to be possible, the T to which the record refers must be known.

Except for this limitation, the cards may be fed in any sequence whatever. Since each card carries the coden of the T it represents and the type and the level of the information it contains, the sorting of the cards to a properly ordered file can be left to the program.

After some of the cards have been prepared (there is no need to prepare all the cards at once), they are run through the computer together with the M.F. creation and update program.

The input of the program - the above-mentined card deck.

Processing and output -

* creation of M.F. including a record for each T, in the form of a random file, but arranged in alphabetical sequence of T; within each record, the information is arranged by type and level (figure No. 8).
* updating the M.F. records in all respects (see below).
* printout of input, for the convenience of the librarian, to ensure follow-up and elimination of errors.
* printout of corrected or updated records.
* printout of error file, listing the errors discovered by the program at the input (figure No. 10).

Corrections are introduced in the file in accordance with the printout and the reported errors. The librarian also feeds additional input cards in at the same time. Both are then run through, a deck of cards at one time. For this purpose each card carries a special field for the action code, which indicates to the program the action to be taken with respect to this particular card:

* Insert - to insert the content of the card into an existing record, or a new record to be inserted into the file.
* replace - to replace the content of the card by the content of the corresponding fields in the same record in the M.F.
* delete - to erase superfluous information erroneously inserted into a record.
* purge - to erase an entire record from the M.F.

These activities are performed both during the original creation of the file and during the entire cycle of mechanized activities, for file updating purposes, in addition to direct updating carried out by other special purpose programs. The created records are recorded and stored on the disk. Updated records are also recorded on the disk, the updated record replacing the old one.

5. RENEWAL OF SUBSCRIPTIONS - PATRONS' LIST

Once the organized file has been created and freed from errors, the mechanized activities can commence.

The subscription period for most periodicals coincides with the calendar year. Orders for these periodicals must be issued to suppliers in September. The subscribers (patrons) are members of different departments, but (in the case of our organization) the Central Library alone handles all subscriptions, and issues purchase orders to suppliers. The program includes the compilation of a Patrons' List which is intended to help the patrons in listing and marking their orders, and to provide the Library with lists of periodicals to be arranged in a systematic manner.

The Patrons' List is essentially an invitation to the patrons to place their orders. It includes a list of all titles in the M.F., ordered in the preceding year. It follows that the master file must be properly arranged and ready for use by the month of June of the current year.

The program of the Patrons' List is now run.

The input is the updated M.F. on the disk.

The output includes:

* a numbered, alphabetical list of all the titles in the file (figure No.2). To the left of each title a space is provided for marking the order, together with other details: coden, the country of origin, and the price per issue, if exceptionally high.
* error file.

Any number of copies of this list can be produced by the program. The copies are then sent to departments together with a covering letter explaining the manner in which the order should be marked on the list and indicating the date by which the list should be returned. It is important that all lists be returned by this date, since the data can then be inserted in the master file before actuating the orders-to-suppliers program in September; in this way orders can be sent to suppliers in time.

6. RENEWAL OF SUBSCRIPTIONS - ORDERS TO VENDORS

At this stage - after the lists have been sent out - the information which is missing must be inserted in the master file. This information is of two kinds:

(1) information which was already available at the time of creation of the file, but which had not been prepared for punching and was not relevant to the preceding program (e.g. particulars of the publisher of each title).

This information can now be inserted with the aid of file creation and update program, with action code "insert" or "replace".

It is recommended that this be done before the lists are returned by the subscribers.

(2) information which becomes available only after the patrons' lists have been returned, but which can already be prepared for insertion into the M.F. Such preparations should be carried out as early as possible. The purpose of this is twofold:

a) To avoid rush work during input preparation owing to some of the lists arriving late, computer breakdowns, correcting card-punching errors, etc.

b) Not to make the librarian do anything the computer can do in his stead. There is no point in a man preparing and punching the information which is based on the M.F. and is already known. The computer can do it more efficiently and with fewer errors, while saving the librarian some of his tedious routines.

The appropriate program will bear the entire M.F., retrieve the coden of each T and the code of its vendor, and will punch one card for each title with the following data:

Coden, 0301, vendor code.

The cards are put out arranged in the alphabetical sequence of T, so that when the patrons' lists arrive, the card corresponding to any desired title can be easily located, and marked with the desired number of copies and the code of the subscriber's department. The cards are then sent for insertion

in the master file with the aid of the creation and update program, after which the M.F. can be operated by the next program.

6.1 Program for Orders to Vendors

With the aid of this program a written order is prepared for each vendor for all the periodicals to be supplied by this vendor. The printer of the computer puts out the list in a form ready to be dispatched to the vendor.

The input consists of the updated M.F. with type 3 cards.
The output and processing consist of the following:

* a letter to the vendor, together with the list of periodicals ordered (figure No. 3). The list is arranged in the alphabetic sequence of titles, together with their respective orders, number of copies ordered and serial number of item, assigned to it by the program.
* Updating of M.F. records, including the assigned item number (see figure No. 8, type 3).
* Punched item card for each item, with the following particulars: Coden, Vendor Code, Item No.
* Error file.

The item cards which are put out are sorted by vendors and by item number.

The idea which underlies the preparation of these cards is to use the output of a program as the input of a subsequent program; again, the librarian is spared the necessity for doing what a computer can do just as well.

In the letter which accompanies the order, vendors are requested to refer to the item number when submitting invoices. If this is insisted upon, most vendors will meet this request.

7. ACCOUNTING

The Library in our organization has no budget allocation out of which to pay for the periodicals subscribed to by the different departments. Each department is debited for the priodicals it subscribes to out of its own allocation, but it can order them only through the Central Library. The departments may act only through the Central Library in everything that concerns orders for periodicals and inquiries and complaints arising therefrom. Thus, it is the Central Library which orders the periodicals from the vendors and charges the sums disbursed in payment of the invoices to the respective departments, in accordance with the data indicated on the invoice and the details of the orders. The Library also checks the actual arrival of periodicals, and issues claims for the periodicals which failed to arrive, if any. The Library must answer inquiries of departments concerning the balance of their library allocation, dates and particulars of debited items, and particulars of periodicals which have already arrived and those yet due to arrive.

The following have been created for this purpose:

debit file;
accounting program;
(control and claims program).

7.1 Debit file

This file (figure No. 9) is also a random access file. Each record refers to a particular department, and can be directly accessed to. Each such record contains all the items charged to the department from the different invoices which have arrived during the current year, each item so charged comprising:

1. The charges for library copies, i.e., for periodicals which the requesting department is willing to leave in the Central Library for general use.
2. The charge for extra copies, i.e. for periodicals which are intended for the exclusive use of the patron and which are sent to him as soon as they have arrived in the Central Library.

In this file all charges are expressed in IL. This is because the different invoices are made out in different currencies, and the total of the items taken from the different invoices will only be meaningful if expressed in a standard currency.

Owing to the particular structure of the record and the file, it is possible:

* to debit the department concerned by random access;
* to keep a statistical record of the ratio between the outlay on library copies and additional copies;
* to keep an up-to-date record of the account of every department at all times.

7.2 Accounting Program

When the vendor's invoice arrives, the item cards (section 6.1, output) for the titles appearing in the invoice are taken out. If the item number appears in the invoice, the card is found by its item number. If it does not (which usually does not happen in more than 15% of the cases),the item number is found in the following manner:

The T is indicated in the invoice. The record of that T is found in the printout of the M.F.; it contains the item number, recorded under type 3.

The card is located and the price indicated in the vendor's invoice for this item is punched on the card. If a sum has been credited by the vendor a negative number is punched. If there is a discrepancy between the number of copies ordered and the number of copies indicated in the invoice, the number of copies given by the invoice is punched in as well.

A leader card containing the particulars of the invoice is placed in front of the card deck (identification of invoice, date of invoice, total price, currency, vendor's code, percent commission, if any). If more than one invoice is run through the computer at the same time, the decks are stacked one behind the other, the last card being left blank (sentinel card indicating the end of data cards).

The input of the program comprises:

* the cards as above;
* the M.F. with information about the departments subscribing to each item.

The processing and the output comprise:

* display of input cards in the sequence of their appearance, to facilitate location of errors (figure No. 4);
* The parts of the price of the item charged to each subscriber department. If the copy was ordered for the Library only, each department pays its proportional part. If the item was especially ordered for the department, the department has to pay the full price, in addition to its share in the price of the copy in the Library. The printout is arranged by departments, and in the alphabetical order of T within each department (figure No. 5);
* insertion of invoice details in the appropriate M.F. record (type 3, figure No. 8);
* total sums charged to each department, to be charged against their respective budget allocations (figure No. 6);
* the following charges are recorded in the debit file for each department for each invoice (figure No. 9):

  sum debited for library copies;
  sum debited for extra copies; } in IL.

  identification and date of invoice.

7.3 Prevention of Erroneous Records in Mass Storage

What are we to do about errors in debit accounting? (or about errors in any other process which results in a record being placed in mass storage?)

Errors can originate from erroneous card punching, from the presence of a wrong card in the deck, etc. These will be located on the printouts put out by the program, but in the meantime the various records in the M.F. and in the debit file on the disk will have been updated. After the errors have been identified, it is necessary to locate all the sites

in the disk which carry the erroneous information and to correct it. This is in no way a trivial task.

Rather than deal with the problem directly, we chose to prevent its occurrence by making a blank run prior to each operational run.

There is no difference between a blank run and an operational run which would affect the accounting program; in other words, the accounting program "does not know" if the run is blank or operational. It accordingly obeys all orders, prints the results and notifications of error and "places" records in the M.F. and in the debit file, except that the updatings made on the disk during a blank run are purged from it at the end of the run and the condition of the disk reverts to what it was prior to the blank run. Changes are not permanent, but are recorded for the duration of the run only.

After the results have been received, the errors are corrected in the data, and the run is repeated. This operation can be repeated time and time again, until the last error has been expunged. The next run is operational (one control card is added), when the error-free data are recorded on the disk in a permanent manner.

This sequence of blank runs and operational runs is carried out whenever the processes, the results of which are to be recorded on the disk or on the tape, are liable to contain errors (e.g. orders-to-vendors program, which provides for the insertion of item numbers in the M.F.).

8. ROUTING AND CONTROL OF ARRIVALS

The number of items arriving in the Library from different sources is very large; they are addressed to different individuals, some of the items being identical while the others differ from one another in one respect or a few respects only. The result is that large libraries can no longer control the routing of the material to its different destinations and, in particular, no longer know if all the items have arrived and are unable to ensure that they all arrive in time.

This problem is dealt with in two steps described in sections 8.1 and 8.2.

8.1. Preliminary Processing and Means of Control

During the period between the dispatch of the orders to vendors and the arrival of the first copies, it is necessary to collect information on the patrons, i.e. on the individuals who have ordered extra copies, in addition to the copy ordered for library use. This information in its original (unprocessed) form is found on the Patrons' List, with the patrons' original order on it. The librarian uses these forms to prepare type 4 cards (figure No. 1).

The input of the program comprises:

* type 4 cards
* the M.F.

Processing and output comprise:

* for each copy and each patron, the program creates two fields in the M.R. (Master Record, i.e. a record in the M.F.) coresponding to a given title.

  The expected date of arrival is placed in the first of the two fields. The second field remains blank to be filled in by the fullfilment and claims program (see section 8.3).

  The structure of the posted M.F. is seen in figure No. 11 (the posting is effected in type 5, which is created by the program for this purpose).

For explanation of figure see section 8.3, processing and output.

* The program creates a punched control card to correspond to each field in the M.F.; this card serves as "identity card" for the particular copy. In this way each copy which has arrived during the year has an "identity card" containing its coden, number of issue, date of issue and the patron (including the library copy) for whom the copy is intended (see figure No. 12 from which the names of the patrons have been removed). In this way a one-to-one correspondence is produced between the cards in the deck and the collection of periodical copies passing through the Library.

  At this stage these cards are not punched, but are stored on a magnetic tape as card images until needed.

* A printout, which includes the input, the updated M.F. and error diagnostics - (figure No. 13).

The type 4 cards which form the input of this program are run through the computer by groups, so as to assist the elimination of errors. These runs are blank, until the last error has been eliminated, after which the deck is sent to the operational run during which the records are inserted in the files.

Each operational run results in the creation of new control cards which are recorded on the magnetic tape. Before they are taken off the tape, they are sorted by the expected dates of arrival of the copies they represent, after which they are taken off the tape in the form of cards and are placed in boxes.

All cards representing the copies expected to arrive by a given date (at 14 day intervals) are placed in a special box with the initial and the terminal dates of the interval marked on it.

8.2 Operation of Routing and Control Process

The procedures to be followed with respect to copies which arrived and those which failed to arrive are outlined below:

On receipt of a copy, the librarian looks for the corresponding card in the box corresponding to the date of arrival.

These cards are sorted within each box by the date and the number of the issue. If there is more than one identical copy (ordered by different patrons), the cards, including their coden, will be identical in all these particulars and are placed together. The librarian now takes out the first card in the group. He reads the name of the patron and the department on the card, sends the copy to its destination and punches a "+" sign in the appropriate field to signify that the copy has now arrived. He then puts the card in the deck to be sent to the computer.

If, at the end of the period, there are any cards left in the box, this means that the copies represented by these cards failed to arrive. The next step is up to the librarian. If, in his view, the delay in the arrival of the copy is reasonable under the prevailing circumstances (postal strike, port stevedores' strike etc.), he will place the card in the box provided for the following 14 days' period. If he thinks the delay is unjustified, he punches a "-" (minus) sign in the appropriate field to say that the copy failed to arrive and must be claimed from the publisher. These cards, too, are put in the card deck to be sent to the computer.

This deck acts as the input of the program to be described in the following section (see section 8.3).

8.3 Insertion, Fullfilment and Claims Program

This program, in conjunction with the program described in section 8.1, is a check on the timely arrival of copies.

The input of the program comprises:

* Check cards ("identity cards") with punched "+" or "-" sign
* The "filled-in" M.F.

Processing and output includes:

* for copies which have arrived - the date of arrival is inserted in the appropriate field of the respective M.R. (figure No. 14).
* for copies which have not arrived - the issue of claim to the publisher and the date of the claim for this particular copy is marked in the appropriate field of the respective M.R. (figure No. 14).

Fields which were shown empty in figure No.11 carry the date of arrival of the copy or of issuance of claim in figure No. 14. The letters (N,E etc.) which appear in the fields, indicate that the numbers may be positive or negative. The absolute value of the number indicates the target date (day of the year), while the sign indicates that the copy has arrived (positive) by this date, or that a claim has been issued (negative).

* a display of the input cards and the updated Master Records.
* error diagnostics.
* claim letters to the publisher (for copies which failed to arrive) ready to be sent out (figure No. 15.)
* a new punched control card for each copy which failed to arrive.

  This card carries the date of dispatch of the latest claim, in addition to the information included in the corresponding original (input) card, but not the "minus" sign of the original card.

  On being ejected from the computer, these cards are placed in the box corresponding to the actual (current) 14-day period (i.e. the period which is contemporaneous with the date of card ejection), where it is ready for the delayed copies as soon as they arrive.

  The process described in sections 8.2 and 8.3 is repeated until the delayed copy has arrived.

9. RETRIEVAL, STATISTICS, QUERIES

Examples which illustrate the advantage of the particular structure of the data base of the system in everything that concerns file interrogation will be found in reference No. 6.

The programs at the disposal of the user enable him to retrieve any records from the files as printout or as punched card deck. To do this, he must identify the records desired and indicate the appropriate action code.

If an organized M.F. which contains all the relevant data is available, this system is very convenient to use in carrying out statistical studies.

The following are examples of such investigations:

a) what is the delay between the date of printing of a periodical and the date of its arrival in the library, which may be expected on statistical grounds?

b) what is the relationship between the original budget allocation for the purchase of library copies for general use and the original budget allocation for the purchase of extra copies for private use?

c) what is the distribution of prices per copy as a function of the number of copies of a given title which have been ordered?
(see figures Nos 16 and 17 for the example of an investigation which failed to yield meaningful results).

10. SUMMARY AND CONCLUSIONS

10.1 Results of Practical Experience

From the practical point of view, the most striking achievement of the system has been the increase in control, reliability and accuracy which is always the more indispensable, the more numerous the data to be processed. Even though, as a result of mechanization which has been introduced in our organization, the manpower employed was not reduced, the mechanization will make it possible to handle a much greater volume of data without losing control of the system.

The fact that the operation of the mechanized system has been extended into its second year, emphasizes the convenience of such mechanization to the librarian. The M.F. for the coming year was compiled from the old M.F.; it contained all the data which could be retrieved from the old M.F. and the only new material which had to be added were the data which change from one year to another (e.g. patrons subscribing to a given periodical during that year).

The operational programs provided by the system not only relieve the librarian from routine duties, but carry out these duties more rapidly and more efficiently than they could ever be carried out by hand. In addition, the librarian is provided with facilities for carrying out non-routine research on his working procedures with the purpose of improving service and reducing the expenses; were it not for the mechanization, he would hardly find any free time for work of this kind.

10.2 Future work

a) Lending

The next obvious step is to extend the mechanized system to include the lending of material out of the Library. In addition to periodicals the Library also contains some 30,000 books and reports, most of which are now out on loan, without any control over the duration of the loan or dates by which they are to be returned to the Library.

b) **Mechanized Catalogue**

We now have at our disposal punched paper tapes produced by the catalogue workers during the past year with the aid of a flexowriter during the printing of the catalogue cards. These tapes can be read by the computer and the files required for the compilation of a mechanized catalogue, can be prepared.

c) Interactive Search with Guidance

We already have an extensive thesaurus in machine-readable form, which was itself created by a computer program (figure No. 18). Its purpose is to serve both the cataloguer and the library user in finding the keywords which will help him in locating the book he needs.

The combination of the mechanized cataloguing system with the thesaurus will make it possible to operate an answers-to-queries guided search program. In order to render the search interactive, the Library will acquire a display terminal which will be connected on-line to the computer; the user will thus have access to the mechanized catalogue and will be able to operate the interactive query program, i.e. modify his query with the aid of the thesaurus, master file and auxiliary files, and thus to arrive at the bibliographic material he requires.

10.3 Manpower and Computer Investment

Experience has shown that the manual system in the Library can be mechanized with the aid of the professional manpower now employed in the Library, if assisted by a computer specialist. In the first stage of these activities the employed personnel have proved themselves capable both of operating the still existing manual system and the mechanical system under construction (except for the aid of key-punchers not belonging to the Library). This seems to be true, irrespective of the size of the Library.

As regards the money investment required, the operation of the systems takes up about one hour of computer time for the yearly cycle of

operations (for a C.D.C. 6500 computer). Additional budget allocations are needed for card punching, printing costs and upkeep of magnetic tapes (as back-up for the files on the disk).

10.4 Other Potential Applications

The applications of the system to various other fields (see reference No. 6) are possible owing to the basic conception of the data base, which can be easily updated, and to the structure of the files which shorten the reaction time to the queries. Moreover should it ever be desired to introduce any changes in the operational structure and the relevant data, this can be done, by and large, by introducing additions and changes in the mechanized operational programs, but no drastic changes will be needed in the structure of the data base or in the operational program system as a whole.

8. REFERENCES

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2. Dodd, G. Generalized Data Management Systems: Data Structures. Iltam, 1971 International Seminar on Information Storage & Retrieval, Proceedings, chapter 3.

3. Hsiao, D., and Harary, F. A Formal System For Information Retrieval From Files.
Comm. ACM 13,2 (Feb. 1970), 67 - 73.

4. Lefkovitz, D. File Structures For On-Line Systems.
Spartan Books, New York, 1969.

5. Random Files — קדמון, נ. מחכונת העבודה עם
Permanent Files — השמורים כ-
53-50 (דצמבר 71) ידיעון רום"ח מס' ד,

6. קדמון, נ. מערכת אוטומציה של מחלקת כתבי העת בספריה,
דו"ח ביניים מס' 1.

7. קדמון, נ. אוטומציה של מחלקת כתבי עת בספריה,
דו"ח מסכם.

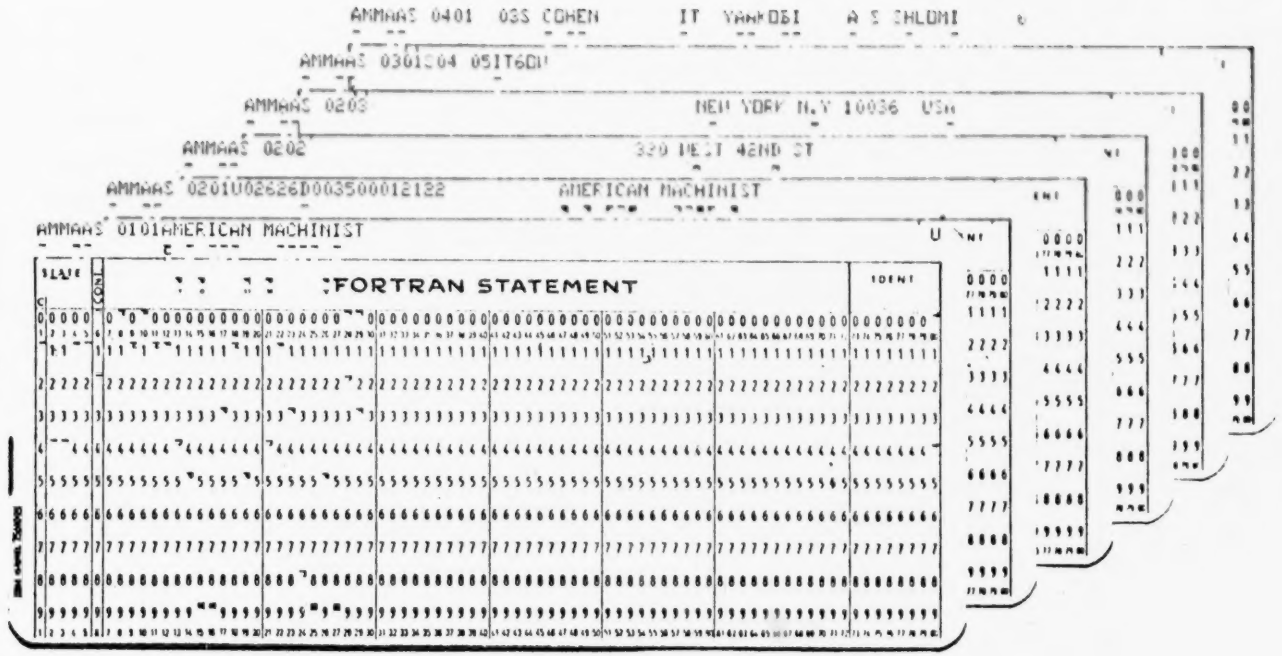

Figure 1: Structure of Master File Cards

141	CYBERNETICA			BELGIUM	CYBEAD
142	CYBERNETICS	130.00	DOLLAR	USA	CYBNAO
143	DA-MA			ISRAEL	DAMACH
144	DAPEI TOCHEN-HASHMAL VEELECTRONICA			ISRAEL	DTHECP
145	DAPEI TOCHEN-ZAVA VEHIMUSH			ISRAEL	DTZHCH
146	DATA PROCESSING			ENGLAND	DPROAX
147	DATA PRODUCT NEWS			USA	DAPNCJ
148	DATAMATION			USA	DTMNAO
149	DEFEKTOSKOPIYA			RUSSIA	DEFKAG
150	DESIGN NEWS			USA	DIGNAS
151	DIFFERENTIAL EQUATIONS	155.00	DOLLAR	USA	DIEQAD
152	DIN MITTEILUNGEN			W GERMANY	DINIGJ
153	DIRECTORY OF PUBLISHED PROCEEDINGS (INTERBOOK)			USA	DPPRAI
154	DISCUSSIONS OF THE FARADAY SOCIETY			ENGLAND	DFSOAY
155	DISSERTATION ABSTRACTS B-ENGINEERING AND TECHNOLOGY			USA	DABSAE
156	DMS-AN EQUIPMENT	350.00	DOLLAR	USA	DMSACV
157	DMS-ELECTRONIC SYSTEMS	350.00	DOLLAR	USA	DMSECX
158	DMS-MILITARY AIRCRAFT	350.00	DOLLAR	USA	DMSMCB
159	DMS-MISSILES SPACECRAFT	350.00	DOLLAR	USA	DMSSCR
160	DOKUMENTATION REGELUNGSTECHNIK (VDI)	400.00	MARK	W GERMANY	DOREGY
161	E.D.N. ELECTRICAL DESIGN NEWS			USA	EDNEAC
162	E.E.E. MAGAZINE OF CIRCUIT DESIGN ENGINEERING			USA	EEECAY
163	EICHUT			ISRAEL	EICHCF
164	ELECTRICAL COMMUNICATIONS			USA	ELCMAB
165	ELECTRO-OPTICS			ENGLAND	ELOPCA
166	ELECTRO TECHNOLOGY NEWSLETTER			USA	ETECAR
167	ELECTROMECHANICAL DESIGN				

Figure 2: Patrons' List

ITEM NO.	CODE	NO. OF COPIES	T I T L E
01029	JPLPAG	01	JOURNAL OF POLYMER SCIENCE,PART A-2,POLYMER PHYSICS
01030	JPYBAZ	01	JOURNAL OF POLYMER SCIENCE,PART B,POLYMER LETTERS
01031	JPYCAG	01	JOURNAL OF POLYMER SCIENCE,PART C,POLYMER SYMPOSIA
01032	JALSAI	02	JOURNAL OF THE ASTRONAUTICAL SCIENCES
01033	JFINAZ	01	JOURNAL OF THE FRANKLIN INSTITUTE
01034	JSMTAW	01	JOURNAL OF THE S.M.P.T.E.
01035	JVSTAJ	02	JOURNAL OF VACUUM SCIENCE AND TECHNOLOGY
01036	LUENAA	01	LUBRICATION ENGINEERING
01037	MACYAI	03	MACHINERY
01038	MAREAV	01	MATHEMATICAL REVIEWS
01039	MCMPAE	01	MATHEMATICS OF COMPUTATION
01040	MEPCAP	01	METAL PROGRESS
01041	TMSAAP	01	METALLURGICAL TRANSACTIONS
01042	XGMRAM	03	MILITARY REVIEW
01043	MSSCZD	01	MILITARY SPECIFICATIONS AND SOURCES
01044	MCCAEX	01	MODERN CASTING
01045	MPHCAI	01	MODERN PHOTOGRAPHY
01046	MCPLAY	02	MODERN PLASTICS INTERNATIONAL
01047	NSANAC	01	NATIONAL SAFETY NEWS
01048	RASCAR	01	RADIO SCIENCE
01049	SPIEAB	01	S.P.I.E. JOURNAL
01050	STNYBH	02	SCIENCE AND TECHNOLOGY
01051	SPRMAY	01	SCREEN PRINTING MAGAZINE
01052	SPPLAH	01	SPACE PROPULSION
01053	LUAMAI	01	STUDIES IN APPLIED MATHEMATICS
01054	TEJCZH	03	TELEMETRY JOURNAL
01055	TAGUAH	01	TRANSACTIONS OF THE AMERICAN GEOPHYSICAL UNION
01056	TSRHAZ	01	TRANSACTIONS OF THE SOCIETY OF RHEOLOGY

Figure 3: Orders to Suppliers

```
ADHAAS S0100200231<
AMMAAS S0100301102E
APNYAS S0100401911<
ATINZV S0100500219<
CMERAV S0100600262E
CHNKAV S0100900262E
CMPCAX S0101000262E
CMPOAD S0101100787E
CPAUAF S0101200218H
CNCNZB S0101300050<
DTMNAD S0101400903<
EEEEAM S0101500415H
ELECAT S0101604209<
FLQUZN S0101701097B
FOUNAE S0101800210<
GPYSAL S0101900162G
HYDPAR S0102001059<
IBMJAE S0102100052E
IAEAAC S0102201443G
JAPNAT S0102301630<
JCISAZ S0102401058D
JCSSBI S0102500333I
JDEQAU S0102600579F
JOMTAK S0102700378<
JPLCAT S0102803579<
JALSAI S0103200240<
JFINAZ S0103300210<
JSMTAH S0103400283E
JVSTAJ S0103500577D
LUENAA S0103600168<
MAREAV S0103803360<
MCMPAB S0103900210<
MACYAI S0103700300<
MEPOAP S0104000111C
TMSAAP S0104100409E
XGMRAM S0104200160E
MSSCZD S0104300577E
MOCABX S0104400157E
MPHOAI S0104500105<
MOPLAY S0104600240<
NSANAC S0104700112<
AICEAK S0100102992E
RASCAR S0104800346E
SPIEAB S0104900190<
STNYBH S0105000302D
SPRMAY S0105100072D
SPPLAH S0105201045B
UUAMAI S0105300138F
TEJOZH S0105401260<
TAGUAH S0105500063<
TSRHAZ S0105600336<
 Q53936   12.10.71  02  00131400042000
```

Figure 4: Accounting - Representation of Printout of Data Cards

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT C

MAZTEN	TITLE	LIB-COP	EX-COP
01015	COMPUTER DECISIONS	+00025.00	+00000.00
01028	INTERNATIONAL JOURNAL FOR NUMERICAL METHODS IN ENGINEERING	+00018.00	+00000.00
01034	JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS	+00036.20	+00000.00
01051	SIMULATION	+00008.00	+00000.00
01062	SOFTWARE PRACTICE AND EXPERIENCE	+00013.20	+00000.00
01096	TRANSACTIONS OF THE AMERICAN MATHEMATICAL SOCIETY	+00060.00	+00000.00

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT E

MAZTEN	TITLE	LIB-COP	EX-COP
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01067	PRODUCT ENGINEERING	+00002.50	+00020.00

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT F

MAZTEN	TITLE	LIB-COP	EX-COP
01005	APPLIED OPTICS	+00008.00	+00042.00
01006	APPLIED PHYSICS LETTERS	+00005.50	+00025.50
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01023	FUSION	+00002.00	+00004.00
01023	FUSION	+00002.00	+00000.00
01029	JOURNAL OF APPLIED PHYSICS	+00005.07	+00000.00
01039	JOURNAL OF THE OPTICAL SOCIETY OF AMERICA	+00007.67	+00000.00
01040	LASER FOCUS	+00006.00	+00038.00
01041	LASERSPHERE	+00004.50	+00009.00
01041	LASERSPHERE	+00034.50	+00038.00

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT H

MAZTEN	TITLE	LIB-COP	EX-COP
01017	ELECTROMECHANICAL DESIGN	+00004.17	+00000.00
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01049	NUCLEAR SCIENCE AND ENGINEERING	+00023.63	+00000.00
01055	PHYSICAL REVIEW LETTERS	+00012.00	+00000.00
01058	PHYSICAL REVIEW,C-NUCLEAR PHYSICS	+00012.00	+00000.00
01073	REVIEW OF SCIENTIFIC INSTRUMENTS	+00004.75	+00028.50
01091	TRANSACTIONS OF THE A.S.M.E.-C:JOURNAL OF HEAT TRANSFER	+00015.38	+00000.00

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT I

MAZTEN	TITLE	LIB-COP	EX-COP
01025	INDUSTRIAL ENGINEERING	+00005.50	+00022.00
01044	MECHANICAL ENGINEERING	+00002.00	+00000.00
01064	POPULAR MECHANICS	+00002.33	+00007.00
01067	PRODUCT ENGINEERING	+00002.50	+00020.00
01069	QUALITY PROGRESS	+00004.67	+00014.00
01088	TOOLING AND PRODUCTION	+00020.00	+00020.00
01094	TRANSACTIONS OF THE A.S.M.E.-F:JOURNAL OF LUBRICATION TECHNOLOGY	+00010.25	+00000.00

INVOICE NO. AD 3192 DATE 24.09.71 VENDOR C DEPARTMENT K

MAZTEN	TITLE	LIB-COP	EX-COP
01003	AMERICAN JOURNAL OF PHYSICS	+00007.67	+00000.00
01016	ELECTRO TECHNOLOGY NEWSLETTER	+00009.33	+00000.00
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01018	ELECTRONIC DESIGN	+00002.92	+00035.00
01029	JOURNAL OF APPLIED PHYSICS	+00005.07	+00000.00
01034	JOURNAL OF MATHEMATICAL ANALYSIS AND APPLICATIONS	+00036.30	+00000.00
01035	JOURNAL OF MATHEMATICAL PHYSICS	+00012.75	+00000.00
01038	JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA	+00005.60	+00006.00
01039	JOURNAL OF THE OPTICAL SOCIETY OF AMERICA	+00007.67	+00046.00
01040	LASER FOCUS	+00006.00	+00000.00

Figure 5: Accounting - Debit Itemization per Department and per Item

```
DEPARTMENT T HAS BIGGEST EXTRA SUM: +00381.40    FOR LIB-SLBS: +00071.32    TOTAL ADDED:     +5.88

        INVOICE NO. AD 3192          DATE  24.09.71          VENDOR  C       DEPARTMENT
      CHARGE DEPARTMENT  =  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00129.50   +00000.00   +000129.50
      CHARGE DEPARTMENT  A  FOR LIP-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00326.99   +00140.75   +000467.74
      CHARGE DEPARTMENT  B  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00030.00   +00150.00   +000180.00
      CHARGE DEPARTMENT  C  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00190.49   +00000.00   +000190.49
      CHARGE DEPARTMENT  D  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00157.50   +00000.00   +000157.50
      CHARGE DEPARTMENT  E  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00008.34   +00090.00   +000098.34
      CHARGE DEPARTMENT  F  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00053.16   +00150.50   +000203.66
      CHARGE DEPARTMENT  H  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00076.05   +00063.50   +000139.55
      CHARGE DEPARTMENT  I  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00048.13   +00083.00   +000131.13
      CHARGE DEPARTMENT  K  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00424.61   +00196.00   +000620.61
      CHARGE DEPARTMENT  L  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00047.00   +00010.00   +000057.00
      CHARGE DEPARTMENT  M  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00027.28   +00065.00   +000092.28
      CHARGE DEPARTMENT  O  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00237.00   +00174.50   +000411.50
      CHARGE DEPARTMENT  P  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00038.11   +00168.50   +000206.61
      CHARGE DEPARTMENT  S  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00070.50   +00075.00   +000145.50
      CHARGE DEPARTMENT  T  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00074.26   +00384.34   +000458.60
      CHARGE DEPARTMENT  U  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00491.33   +00106.50   +000597.83
      CHARGE DEPARTMENT  W  FOR LIB-COP, EX-COF, TOTAL,  AS FCLLOWING-      +00070.87   +00050.60   +000121.47
      CHARGE DEPARTMENT  X  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00473.05   +00154.50   +000627.55
      CHARGE DEPARTMENT  3  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00007.67   +00014.00   +000021.67
      CHARGE DEPARTMENT  5  FOR LIB-COP, EX-COP, TOTAL,  AS FCLLOWING-      +00223.57   +00366.35   +000589.92
IEMTZU D02001002004
ISHAISISOOO113.10.7105  005464410420DF
```

Figure 6: Accounting - Debit Totals

ERROR FILE OUTPUT.

```
NO TYP 03 FOUND       IN INVOICE PP-317/72  IN CODEN NFSAAO IN HAZTEM 02001
INVALID CODEN         IN INVOICE  16.038    IN CODEN AFSPBV IN HAZTEM 02001
NON NUMERIC IN TYP 3  IN INVOICE  16.038    IN CODEN ELOCZG IN HAZTEM 02002
INVALID CODEN         IN INVOICE  16.038    IN CODEN ELWACN IN HAZTEM 02003
INVALID CODEN         IN INVOICE  16.038    IN CODEN POELAN IN HAZTEM 02005
INVALID CODEN         IN INVOICE 35/10922/4 IN CODEN HAWEAR IN HAZTEM 01001
NO TYP 03 FOUND       IN INVOICE   15052    IN CODEN SOVIAN IN HAZTEM 02002
INVALID CODEN         IN INVOICE   15052    IN CODEN MADEAS IN HAZTEM 02001
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN CPELAO IN HAZTEM 01002
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN CPCOBK IN HAZTEM 01001
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN IEJQAV IN HAZTEM 01003
INVALID CODEN         IN INVOICE  Q53936    IN CODEN IJSCBU IN HAZTEM 01006
INVALID CODEN         IN INVOICE  Q53936    IN CODEN IJSCBU IN HAZTEM 01005
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN IEARAJ IN HAZTEM 01010
NON NUMERIC IN TYP 3  IN INVOICE  Q53936    IN CODEN IETPAM IN HAZTEM 01012
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN ITADAI IN HAZTEM 03014
NO TYP 03 FOUND       IN INVOICE  Q53936    IN CODEN IEMCAQ IN HAZTEM 01028
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IETDAG IN HAZTEM 01030
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IICIAU IN HAZTEM 01035
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IEIMAO IN HAZTEM 01039
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IEIMAO IN HAZTEM 01040
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IETMAR IN HAZTEM 01044
NON NUMERIC IN CARD   IN INVOICE  Q53936    IN CODEN IETNAY IN HAZTEM 01046
INVALID CODEN         IN INVOICE  Q53936    IN CODEN IEPMAX IN HAZTEM 01047
******** END OF ERROR-FILE ********
```

Figure 7: Accounting - Error Diagnostics

```
001
BAC SAH
AJP IAC
BAC SAH 0101AMERICAN CERAMIC SCCIEY BULLETIN


005
AJP IAC
AMM AAS
AJP IAC 0101AMERICAN JOURNAL OF PHYSICS
AJP IAC 0201U01212C002200012122          AMERICAN INSTITUTE OF PHYSICS
AJP IAC 0202                             335 EAST 45 STREET
AJP IAC 0203                             NEW YORK N.Y. 10017  USA
AJP IAC 0301CC1103AXK                  01003AD 3192   24.09.71  C00239001


005
AMM AAS
AMS CAK
AMM AAS 0101AMERICAN MACHINIST
AMM AAS 0201U02626D093500012122          AMERICAN MACHINIST
AMM AAS 0202                             330 WEST 42ND ST
AMM AAS 0203                             NEW YORK N.Y 10036  USA
AMM AAS 0301S03 04FIWO                 01003


005
AMS CAK
ASI NZS
AMS CAK 0101AMERICAN SCIENTIST
AMS CAK 0201U0060600009500012122         SOCIETY OF SIGMA XI
AMS CAK 0202                             155 WHITNEY AVE
AMS CAK 0203                             NEW HAVEN CONN.06510  USA
AMS CAK 0301FC2 04FCUK                 01001


001
ASI NZS
ANA LAM
ASI NZS 0101AMERICAN SOCIETY FOR INFORMATION SCIENCE NEWSLETTER


002
ANA LAM
AAB SAB
ANA LAM 0101ANALYST
ANA LAM 0301B01 01C                    01002


002
AAB SAB
ANC HAU
AAB SAB 0101ANALYTICAL ABSTRACTS
AAB SAB 0301B01 01C                    01003


005
ANC HAU
ACI EAM
ANC HAU 0101ANALYTICAL CHEMISTRY
ANC HAU 0201 01313       012122          AMERICAN CHEMICAL SOCIETY
ANC HAU 0202                             1155 SIXTEENTH STREET N.W.
ANC HAU 0203                             WASHINGTON D.C. 20036  USA
ANC HAU 0301D01 01C                    01001
```

Figure 8: Printout of Master File Records

```
   T-KEY= 001
006   DEBI-1   A
000210<001260< A05041   23.09.71
013733F005911EAD 3192   24.09.71
011412000016537EISHAISIS000113.10.71
000157E001260<02-3094   19.10.71
000126<000000<CE29MPHAF07.09.71
003012<000000<  67632   25.10.71

   T-KEY= 002
004   DEBI-1   E
000210<001260< A05041   23.09.71
000350C00378J<AD 3192   24.09.71
001267A006762DISHAISIS000113.10.71
000126<000630<CE29MPHAF07.09.71

   T-KEY= 003
003   DEBI-1   H
000210<001260< A05041   23.09.71
003194A002667<AD 3192   24.09.71
000447C002866EISHAISIS000113.10.71

   T-KEY= 004
005   DEBI-1   K
000210<001260< A05041   23.09.71
017833F008232<AD 3192   24.09.71
005927E002866EISHAISIS000113.10.71
000157E001260<02-3094   19.10.71
000000<000108<   2339   14.11.71

   T-KEY= 005
005   DEBI-1   T
000210<001260< A05041   23.09.71
003118I016142CAD 3192   24.09.71
001585E005468DISHAISIS000113.10.71
000157E001260<02-3094   19.10.71
001334<000000<  67632   25.10.71

   T-KEY= 006
005   DEBI-1   5
000210<001260< A05041   23.09.71
009389I015386GAD 3192   24.09.71
015251E020103GISHAISIS000113.10.71
000315<002520<02-3094   19.10.71
000126<000000<CE29MPHAF07.09.71

   T-KEY= 007
002   DEBI-1   =
005439<000000<AD 3192   24.09.71
001674E003263DISHAISIS000113.10.71
```

Figure 9: Printout of Records in Debit File

```
                    ERROR  FILE  OUTPUT.

ERRONEOUS TYP-LEV OR ACT-COD,      IN CODEN  OSBUZU   TYPE 03   LEVEL 01

ERRONEOUS TYP-LEV OR ACT-COD,      IN CODEN  BJOSZF   TYPE 03   LEVEL 01

ERRONEOUS CHECK-LETTER.   PUT V    IN CODEN  CMERA    TYPE 01   LEVEL 01

ERRONEOUS DECK. MISSING TYPE 01
CMERA  0301001 01C

ERRONEOUS CHECK-LETTER.   PUT F    IN CODEN  PQIMA    TYPE 01   LEVEL 01

ERRONEOUS DECK. MISSING TYPE 01
PQIMA  0301M01 01X

ERRONEOUS TYP-LEV OR ACT-COD,      IN CODEN  ADEGBE   TYPE 03   LEVEL 01

******** END  OF  ERROR-FILE ********
```

Figure 10: Updating - Error Diagnostics

```
AVWEAT 0537287   287   287   287   287   287   287   287   287   287   287
AVWEAT 0538294   294   294   294   294   294   294   294   294   294   294
AVWEAT 0539294   294   301   301   301   301   301   301   301   301   301
AVWEAT 0540301   301   301   301   301   304   304   304   304   304   304
AVWEAT 0541304   308   308   308   308   308   308   308   315   315   315
AVWEAT 0542315   315   315   315   315   315   315   315   315   315   315
AVWEAT 0543322   322   322   322   322   322   322   322   322   322   322
AVWEAT 0544322   322   322   329   329   329   329   329   329   329   329
AVWEAT 0545329   329   329   329   329   329   336   336   336   336   336
AVWEAT 0546336   336   336   336   336   336   336   336   336   343   343
AVWEAT 0547343   343   343   343   343   343   343   343   343   343   343
AVWEAT 0548343   350   350   350   350   350   350   350   350   350   350
AVWEAT 0549350   350   350   350   357   357   357   357   357   357   357
AVWEAT 0550357   357   357   357   357   357   357   364   364   364   364
AVWEAT 0551364   364   364   364   364   364   364   364   364   364   371
AVWEAT 0552371   371   371   371   371   371   371   371   371   371   371
AVWEAT 0553371   371   378   378   378   378   378   378   378   378   378
AVWEAT 0554378   378   378   378   378   385   385   385   385   385   385
AVWEAT 0555385   385   385   385   385   385   385   385   392   392   392
AVWEAT 0556392   392   392   392   392   392   392   392   392   392   392
AVWEAT 0557399   399   399   399   399   399   399   399   399   399   399
AVWEAT 0558399   399   399   406   406   406   406   406   406   406   406
AVWEAT 0559406   406   406   406   406   406   413   413   413   413   413
AVWEAT 0560413   413   413   413   413   413   413   413   413   420   420
AVWEAT 0561420   420   420   420   420   420   420   420   420   420   420
AVWEAT 0562420   427   427   427   427   427   427   427   427   427   427
AVWEAT 0563427   427   427   427   434   434   434   434   434   434   434
AVWEAT 0564434   434   434   434   434   434   434   441   441   441   441
AVWEAT 0565441   441   441   441   441   441   441   441   441   441   448
AVWEAT 0566448   448   448   448   448   448   448   448   448   448   448
AVWEAT 0567448   448

BAUVZD 0101BASADNB UVAMIFAL
BAUVZD 0201I00F06        01?123060  01313
BAUVZD 04010103
BAUVZD 0501121   121   121   121   182   182   182   182   243   243   243   024
BAUVZD 0502243   304   304   304   304   365   365   365   365   426   426
BAUVZD 0503426   426

BHIAZZ 0101BITOH HEIL HAAVIP
BHIAZZ 0201I00C03I000A00013123035  05252
BHIAZZ 04010103
BHIAZZ 0501071   071   071   071   193   193   193   193   315   315   315   012
BHIAZZ 0502315

BJNTAS 0101BRITISH JOURNAL OF NON DESTRUCTIVE TESTING
BJNTAS 0201E00F06L0104500013123060  01313
BJNTAS 0301B021Q4JXIW                 00022
BJNTAS 04010103
BJNTAS 0501121   182   243   304   365   426
```

Figure 11: Routing and Control - Recording in the Master File

```
1938HIAZZ0002060B                                                    006
1938HIAZZ0002060F                                                    007
1938HIAZZ0u020606                                                    008
3158HIAZZ0u03J610 L I B R A P Y                                      009
3158HIAZZ0003J610                                                    010
3158HIAZZ0u030610                                                    011
3158HIAZZ0003J610                                                    012
05uCHAMZS0001300l L I B R A R Y                                      001
u5uCHAMZS0001300l                                                    002
05uCHAMZS00u13001                                                    003
u5uCHAMZSL001300l                                                    004
u80CHAMZS0002290L2 L I B R A P Y                                     005
090CHAMZS0u022902                                                    006
080CHAMZS00022902                                                    007
u8uCHAMZS0u022902                                                    008
120CHAMZS00033003 L I B R A P Y                                      009
12uCHAMZS00033u03                                                    010
120CHAMZS00033003                                                    011
120CHAMZS00033003                                                    012
150CHAMZS0004290l L I B R A P Y                                      013
15uCHAMZS0004290u                                                    014
150CHAMZS0004290l                                                    015
15uCHAMZS0u04290u                                                    016
18uCHAMZS0Ju52905 L I B R A P Y                                      017
180CHAMZS00u52905                                                    018
180CHAMZS0005290S                                                    019
180CHAMZS00052905                                                    020
21uCHAMZS0J062806 L I B R A P Y                                      021
210CHAMZSuJ062806                                                    022
21uCHAMZSu0062806                                                    023
210CHAMZS00062806                                                    024
240CHAMZSu0728u7 L I B R A P Y                                       025
240CHAMZS0007280l                                                    026
24uCHAMZSu072807                                                     027
240CHAMZS0007280l                                                    028
270CHAMZS00u8270A L I B R A P Y                                      029
270CHAMZSuJu82708                                                    030
270CHAMZS000827u8                                                    031
270CHAMZSu0u82708                                                    032
300CHAMZS00092609 L I B R A P Y                                      033
300CHAMZS0J092eu9                                                    034
300CHAMZS0009260S                                                    035
30JCHAMZSuC092609                                                    036
330CHAMZS00102610 L I B R A R Y                                      037
330CHAMZS0u102610                                                    038
330CHAMZS00102610                                                    039
330CHAMZS00102610                                                    040
350CHAMZS0011251A1 L I B R A R Y                                     041
350CHAMZSuJ11251A                                                    042
350CHAMZSuJ11251A1                                                   043
350CHAMZS011251A1                                                    044
390CHAMZS0112251Z L I B R A P Y                                      045
390CHAMZS00122512                                                    046
39JCHAMZSuJ122512                                                    047
390CHAMZS0J122512                                                    048
```

Figure 12: Routing and Control - Control Cards

ERROR FILE OUTPUT.

```
ERRONEOUS DECK. MISSING TYPE 01
AAMAAS 0401  02

ERRONEOUS DECK. MISSING TYPE 01
AMSOAK 0401  01

ERRONEOUS DECK. MISSING TYPE 01
AMPEAT 0401  02

ERRONEOUS DECK. MISSING TYPE 01
APOPAM 0401  01

ERRONEOUS DECK. MISSING TYPE 01
ARAPAW 0401  02

INVALID DATA IN TYPE 02 OF MODIFIED ME.
ARMYAF 0101ARMY
ARMYAF 0201U01312000000S0013123060
ARMYAF 0301F03103XPO                    00209
ARMYAF 04010101

INVALID DATA IN TYPE 02 OF MODIFIED ME.
ARDVAF 0101ARMY RESEARCH AND DEVELOPMENT
ARDVAF 0201U00060000030013123                                    SUPERINTENDEN
ARDVAF 0302MENTS              GOVERNMENT PRINTING OFFICE                    WA
ARDVAF 0303D.C.  20402  USA
ARDVAF 04010102

ERRONEOUS DECK. MISSING TYPE 01
ARPLAP 0401  01

NO TYPE 02 FOUND IN MODIFIED ME
BSTJAF 0101BELL SYSTEM TECHNICAL JOURNAL
BSTJAF 0301F03103STKUCOA                00213
BSTJAF 04010101

ERRONEOUS DECK. MISSING TYPE 01
BRPLAW 0401  01

NO TYPE 02 FOUND IN MODIFIED ME
CSPJAM 0101CANADIAN AERONAUTICS AND SPACE JOURNAL
CSPJAI 0301M0110254                     00304
CSPJAI 04010101

******** END OF ERROR-FILE ********
```

Figure 13: Routing and Control - Error Diagnostics

```
CHA8AE 0101CHEMICAL ABSTRACTS
CHA8AE 0201U75826003040001123045  152                    CHEMICAL ABSTRACTS SER
CHA8AE 0202VICE                P.O.BOX 3012                    UNIVERSITY
CHA8AE 0203POST OFFICE                  COLUMBUS, OHIO 43210  USA
CHA8AE0301X0410306FX                    00575
CHA8AE 04010104
CHA8AE 0501091266091266091266091266091266091266N091266N091266N09826E09826E4A8
CHA8AE 0502091266091266091266091266091266091266N091266N105266105266105266105266
CHA8AE 0503105266105266105266105266105266N112266112266112266112266112266
CHA8AE 0504112266112   112266119   119   119   119   119   119   119   119
CHA8AE 0505119   126   126   126   126   126   126   126   126   126   133
CHA8AE 0506133   133   133   133   133   133   133   133   140   140   140
CHA8AE 0507140   140   140   140   140   140   147   147   147   147   147
CHA8AE 0508147   147   147   147   154   154   154   154   154   154   154
CHA8AE 0509154   154   161   161   161   161   161   161   161   161   161
CHA8AE 0510168   168   168   168   168   168   168   168   168   175   175
CHA8AE 0511175   175   175   175   175   175   175   182   182   182   182
CHA8AE 0512182   182   182   182   182   189   189   189   189   189   189
CHA8AE 0513189   189   189   196   196   196   196   196   196   196   196
CHA8AE 0514196   203   203   203   203   203   203   203   203   203   210
CHA8AE 0515210   210   210   210   210   210   210   210   217   217   217
CHA8AE 0516217   217   217   217   217   217   224   224   224   224   224
CHA8AE 0517224   224   224   224   231   23    231   231   231   231   231
CHA8AE 0518231   231   238   238   238   238   238   238   238   238   238
CHA8AE 0519245   245   245   245   245   245   245   245   245   252   252
CHA8AE 0520252   252   252   252   252   252   252   259   259   259   259
CHA8AE 0521259   259   259   259   259   266   266   266   266   266   266
CHA8AE 0522266   266   266   273   273   273   273   273   273   273   273
CHA8AE 0523273   280   280   280   280   280   280   280   280   280   287
CHA8AE 0524287   287   287   287   287   287   287   287   294   294   294
CHA8AE 0525294   294   294   294   294   294   301   301   301   301   301
CHA8AE 0526301   301   301   301   308   308   308   308   308   308   308
CHA8AE 0527308   308   315   315   315   315   315   315   315   315   315
CHA8AE 0528322   322   322   322   322   322   322   322   322   329   329
CHA8AE 0529329   329   329   329   329   329   329   329   336   336   336
CHA8AE 0530336   336   336   336   336   343   343   343   343   343   343
CHA8AE 0531343   343   343   350   350   350   350   350   350   350   350
CHA8AE 0532350   357   357   357   357   357   357   357   357   357   364
CHA8AE 0533364   364   364   364   364   364   364   364   371   371   371
CHA8AE 0534371   371   371   371   371   371   378   378   378   378   378
CHA8AE 0535378   379   378   378   385   385   385   385   385   385   385
CHA8AE 0536385   385   392   392   392   392   392   392   392   392   392
CHA8AE 0537330   399   399   399   399   399   399   399   399   406   406
CHA8AE 0538406   406   406   406   406   406   406   413   413   413   413
CHA8AE 0539413   413   413   413   413   420   420   420   420   420   420
CHA8AE 0540420   420   420   427   427   427   427   427   427   427   427
CHA8AE 0541427   434   434   434   434   434   434   434   434   434   441
CHA8AE 0542441   441   441   441   441   441   441   441   448   448   448
CHA8AE 0543448   448   448   448   448   448
```

Figure 14: Routing and Control - the Updated Master File

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THANK YOU FOR YOUR CO-OPERATION.

SINCERELY YOURS,

E. ROESLER
ACQUISITIONS DEPARTMENT

Figure 15: Routing and Control - Claim to the Publisher

```
******** END OF PERIODICALS LIST ********
SLES= 01 TOTAL= 397 TOT-PRICE= 09716992  MEAN PRICE= 0244.78
SLES= 02 TOTAL= 073 TOT-PRICE= 00970979  MEAN PRICE= 0132.95
SLES= 03 TOTAL= 027 TOT-PRICE= 00248521  MEAN PRICE= 0092.04
SLES= 04 TOTAL= 007 TOT-PRICE= 00042288  MEAN PRICE= 0060.38
SLES= 05 TOTAL= 003 TOT-PRICE= 00041320  MEAN PRICE= 0137.73
SLES= 06 TOTAL= 003 TOT-PRICE= 00010618  MEAN PRICE= 0035.36
SLES= 07 TOTAL= 001 TOT-PRICE= 00012600  MEAN PRICE= 0126.00
SLES= 09 TOTAL= 004 TOT-PRICE= 00046200  MEAN PRICE= 0115.50
SLES= 11 TOTAL= 001 TOT-PRICE= 00016800  MEAN PRICE= 0168.00
SLES= 12 TOTAL= 003 TOT-PRICE= 00034650  MEAN PRICE= 0115.50
SLES= 13 TOTAL= 002 TOT-PRICE= 00025830  MEAN PRICE= 0129.15
SLES= 14 TOTAL= 001 TOT-PRICE= 00012600  MEAN PRICE= 0126.00
SLES= 18 TOTAL= 001 TOT-PRICE= 00011025  MEAN PRICE= 0110.25
SLES= 19 TOTAL= 001 TOT-PRICE= 00014700  MEAN PRICE= 0147.00
```

Figure 16: Distribution of Prices per Copy - Summary Table

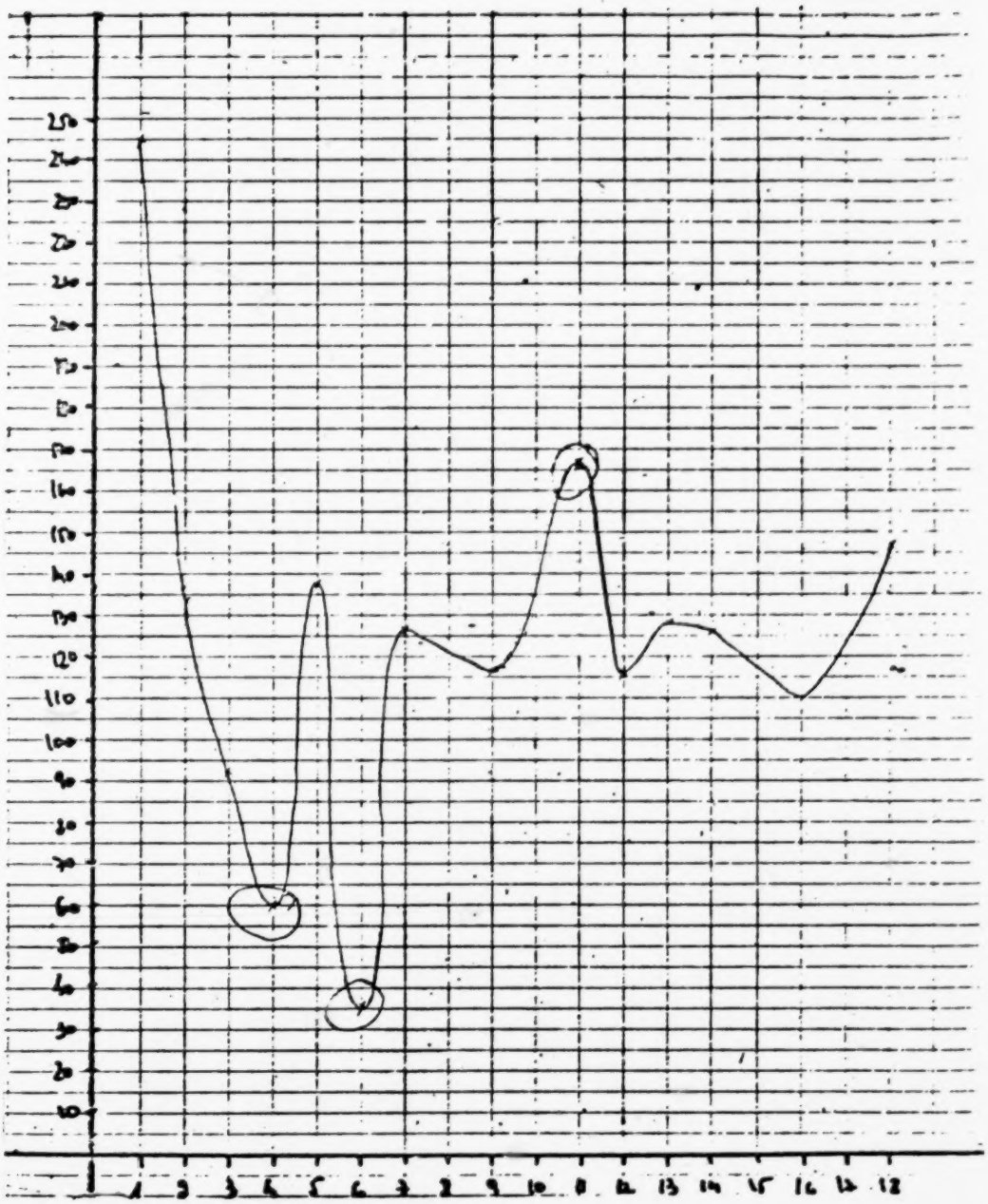

Figure 17: Distribution of Prices per Copy - Diagram

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BT MANAGEMENT THEORY, METHOD, SYSTEM
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MANAGEMENT INFORMATION SYSTEMS
BT DATA PROCESSING; AUTOMATIC
BT MANAGEMENT PRINCIPLES; AUTOMATION
BT MANAGEMENT THEORY, METHOD, SYSTEM

MANAGEMENT OF PRODUCTION
US PRODUCTION MANAGEMENT AND CONTROL

MANAGEMENT OF RESEARCH
65.015.001.5
BT RESEARCH
NT SUPERVISION OF SCIENTISTS + ENGINEERS
RT ECONOMIC ASPECTS, SCIENCE AND TECHNOLOGY
RT MANAGEMENT

MANAGEMENT PERSONNEL
658.3
NT MANAGEMENT PERSONNEL SELECTION
NT SUPERVISION OF SCIENTISTS + ENGINEERS
NT WORK STUDY AND MEASUREMENTS
RT INCOMPETENCE; FAILURE
RT INDUSTRIAL RELATIONS
RT MANPOWER
RT PERFORMANCE EVALUATION
RT PERSONNEL, HUMAN RELATIONS
RT PROFESSIONAL PERSONNEL
RT WAGES, SALARIES, PAY
SF PERSONNEL

MANAGEMENT PERSONNEL SELECTION
658.311
BT MANAGEMENT PERSONNEL
BT PERSONNEL, HUMAN RELATIONS
BT SELECTION (GENERAL)
RT INTERVIEWING
SF PERSONNEL

Figure 18: Thesaurus produced by the Computer